ACCESSION #: 9608010148

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Millstone Nuclear Power Station Unit 1 PAGE: 1 OF 6

DOCKET NUMBER: 05000245

TITLE: Spent Fuel Pool Cooling Capability

EVENT DATE: 09/17/93 LER #: 93-011-02 REPORT DATE:

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: N POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:

50.73(a)(2)(ii)

LICENSEE CONTACT FOR THIS LER:

NAME: Robert W. Walpole, Nuclear Licensing

Supervisor TELEPHONE: (860) 440-2191

COMPONENT FAILURE DESCRIPTION:

CAUSE: SYSTEM: COMPONENT: MANUFACTURER:

REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On September 17, 1993, with the plant at 100 percent power (1030 psig, 530 degrees Fahrenheit), it was determined through engineering analysis that during prior refueling outages the spent fuel pool cooling system, by itself, would have been incapable of maintaining pool temperature below the 150 degree Fahrenheit design limit, under certain conditions. The conditions in question involve the transfer of a full reactor core into the spent fuel pool. In an analysis assuming a full core offload beginning 150 hours after reactor shutdown, and assuming maximum ultimate heat sink temperature (75 degrees Fahrenheit) and a single active equipment failure of the "A" train of Shutdown Cooling System, with no compensatory actions to restore adequate cooling capability, it was

determined that the spent fuel pool temperature would exceed the acceptance limit.

NNECO's typical practice during refueling outages has been to perform full core offloads. Additionally, a review of data from previous refueling outages revealed that on nine occasions, a reactor core offload commenced sooner than 1 50 hours after reactor shutdown.

Refinement of supporting analyses was completed and appropriate schedular and procedural controls were implemented during RFO14

There were no safety consequences as a result of this event and no safety systems were required to operate as a result of this event.

I. Description of Event

On September 17, 1993, with the plant at 100 percent power (1030

psig, 530 degrees Fahrenheit), it was determined through engineering

analysis that during prior refueling outages the spent fuel pool

cooling system, by itself, would have been incapable of maintaining

pool temperature below the 150 degree Fahrenheit design limit, under

certain conditions.

NNECO's refueling practice at Millstone Unit No. 1 is to offload the

full core to the spent fuel pool. This practice is not consistent with the "normal" refueling analyzed in the Updated Final Safety Analysis Report (UFSAR). To assess this past condition, NNECO performed an analysis that assumes the transfer of a full reactor core into the spent fuel pool beginning 150 hours after reactor shutdown, at a rate of 10 fuel assemblies per hour. Following completion of fuel transfer, the shutdown cooling system, which is cross-connected to the spent fuel pool cooling system to provide adequate cooling capability, is assumed to fail. Ultimate heat sink temperature of 75 degrees Fahrenheit is assumed consistent with the maximum allowable per Technical Specifications. Results indicated that, under these conditions, the spent fuel pool temperature would exceed 150 degrees Fahrenheit. These results are not consistent with the Millstone 1 UFSAR, and the Safety Evaluation Report for License Amendment 40, which provided for expanded spent fuel pool storage capability in 1988. Based on the above, this event was reported on September 17, 1993, per the requirements of 10CFR50.72, as a condition that was outside the design basis of the plant.

A review of data from previous refueling outages revealed that on nine occasions, a reactor core offload commenced sooner than 150 hours after reactor shutdown.

A further review of the Spent Fuel Pool design history determined that no 10CFR50.59 safety evaluation had been performed on the

impact of exceeding the "normal" discharge batch size from one-quarter core to one-third core for the 1 980 refueling outage (end of cycle (EOC) 7), until the Spent Fuel Pool rerack project was implemented in 1988 at the end of cycle 11 (NRC Safety Evaluation Report for License Amendment 40). The increased heat load in the Spent Fuel Pool was not evaluated and potentially could have resulted in exceeding the Spent Fuel Pool Cooling system design heat removal rating for normal offloads, as evaluated in the Safety Evaluation Report for License Amendment 39. This increase is bounded by the analysis of the full core offload described above. There were no safety consequences as a result of this event.

II. Cause of Event

The "normal" refueling sequence described in the Millstone 1 UFSAR assumes discharge of only one third of the core into the spent fuel pool. In practice, Millstone 1 typically performs a full core offload, which, by the UFSAR definition, is considered to be an "emergency" or "abnormal" refueling sequence. The 1988 rerack analysis assumed a single failure for the "normal" refueling event. Additionally, USNRC Standard Review Plan (NUREG-0800) provides analysis criteria for the spent fuel pool rerack project which specifies that a single failure be assumed for the "normal" sequence, but not for the "abnormal" sequence. This SRP was used as guidance in developing the 1988 rerack analysis. Applying this

"normal" criterion to the full core offload scenario, with no manual compensatory measures being performed, results in exceeding the design criterion for the spent fuel pool.

This condition represents a discrepancy in ensuring that operations were conducted in accordance with assumptions in the spent fuel pool cooling capability engineering analysis. This is attributable to two factors. First, engineering analysis assumptions were not incorporated into operating procedures or controls, allowing a discrepancy to develop. Second, unit management was insufficiently aware of design basis analyses, and thus did not insure refueling practice conformed to analysis assumptions.

A further contributing factor is the depth of review of the analysis performed in support of the 1988 and 1976/77 spent fuel pool rerack projects, including the review done by the Plant Operations Review Committee (PORC). Neither PORC nor any other review organization identified the discrepancy between actual practice and analysis assumptions.

An additional contributor to this event has been determined to be the inadequacy of the 10CFR50.59 safety evaluation for core reloads between cycle 7 and cycle 11. The change from one-quarter to one-third core was evaluated for reactor impacts, but the evaluation failed to consider the impact of changing the reload batch size on

the Spent Fuel Pool.

III. Analysis of Event

This event is being reported per the requirements of 10CFR50.73(a)(2)(11)(B), as a condition that is outside the design basis of the plant.

A Millstone 1 specific analytical model was developed and analysis was initiated to evaluate the identified discrepancy between typical refueling practice and the licensing analysis. NNECO sought to determine the peak spent fuel pool temperatures that could occur during the event in question. The analysis assumed the following conditions:

1. Full core offload begins 150 hours following plant shutdown.
2. Fuel is transferred into the spent fuel pool at a rate of 10 assemblies per hour.
3. The Cooling water supply to the spent fuel pool cooling heat exchangers is 85 degrees Fahrenheit.
4. Concurrent with completion of core offload, the shutdown cooling system, which is manually cross-connected to augment spent fuel pool cooling system capability during refueling evolutions, experiences a system failure.
5. No mitigating compensatory actions are taken.

Results of this analysis indicate that the resulting spent fuel pool bulk temperature would be approximately 212 degrees Fahrenheit. If

consideration is given for evaporative cooling of the pool, the resulting temperature would be 186 degrees Fahrenheit. Both of these temperature analyses exceed the 150 degree Fahrenheit design criterion of the spent fuel pool for a normal refueling.

Historically, as shown in Table 1, full core offloads have occurred as regular practice at Millstone 1 and, in many cases, full core offloads have commenced before 150 hours of decay time.

Table 1 "Millstone Unit 1, Cycle 1 Through 15 Core Offload Times" omitted.

To assess the significance of this matter, NNECO has performed a retrospective assessment of decay heat loads in the spent fuel pool for each refueling outage at the time of the end of fuel movement. The actual heat loads are shown in Table 2. These heat loads are representative of the maximum heat loads in the spent fuel pool. Table 2 also includes a comparison, for each refueling outage, of these maximum heat loads to the available cooling capability, For most refueling outages, the actual heat loads exceeded the design capability of the spent fuel pool cooling system heat exchangers (7.84E +06 BTU/Hr) and the assumed design limit for the "normal" case as applicable at the time. When crediting one train of the shutdown cooling system (which in practice was aligned to the spent fuel pool as needed), total available cooling design capability (29.84E +06 BTU/Hr) was never exceeded.

Likewise, the heat load assumed for the abnormal" case was not exceeded

This assessment highlights the single failure vulnerability of the spent fuel pool cooling capability for full core offloads that existed prior to refueling outage 14. However, in practice the temperature of the spent fuel pool never exceeded the design acceptance criterion.

NUSCo reviewed the heat load for each of the impacted discharge batches (those greater than one-quarter core), which occurred between 1979 and 1988. The conclusion was that the increased discharge batch size heat load never exceeded the Spent Fuel Pool heat load rating for the normal discharge case.

Table 2 "Millstone Unit 1, Maximum Decay-Heat Loads for Cycle 1 Through 15" omitted.

IV. Corrective Action

The following actions were performed in response to this event for RFO14:

1. Cycle-specific procedural and schedular controls were put in place during RFO14 January, 1994. These controls provided guidance for core decay time and maximum cooling water temperatures, to ensure that the maximum spent fuel pool bulk temperature would remain less than approved limits following the limiting single failure event during the full core offload.

2. The Millstone 1 UFSAR was revised to reflect the information

available as of RFO14.

The following actions were performed prior to RFO15:

1. A plant design (change was implemented to provide a second train of shutdown cooing to supplement fuel pool cooling, eliminating the single failure vulnerability.

2. A License Amendment was applied for and granted to specifically authorize a revision to the UFSAR description to allow a partial or full core offload during refueling as a normal end of-cycle event.

3. Pursuant to the license amendment, operating procedures have been implemented to incorporate appropriate operational limitations regarding full core offloads to assure consistency with analysis assumptions.

4. The operating requirements of the spent fuel pool have been addressed, and they are located in the Millstone Unit No. 1 Technical Requirements Manual.

The following actions were performed during RFO15:

1. The effectiveness of PORC was assessed and addressed in NNECO's response to NRC Inspection Report No. 50-245/95-34. Additional corrective actions taken include improvements to procedures and training, in order to provide better understanding of what constitutes a plant design change, and what facets of those

changes require a safety evaluation pursuant to 10CFR50.59.

V. Additional Information

Commitments

There are no commitments contained within this letter. All

corrective actions have been completed.

*** END OF DOCUMENT ***